

Analysis of Heat Transfer and Energy Saving Characteristics for Bobsleigh/Skeleton Ice Track

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Abstract : Enhancing the heat transfer characteristics of the bobsleigh/skeleton ice track and reducing the energy consumption of the bobsleigh/skeleton ice track plays an important role in energy saving of the refrigeration systems. In this study, a track ice-making test rig was constructed to verify the accuracy of the established ice track heat transfer model. The different meteorological conditions on the variations in the heat transfer characteristics of the ice surface, ice temperature, and evaporation temperature with or without Terrain Weather Protection System (TWPS) were investigated, and the influence of the TWPS with and without low emissivity materials on these indexes was also compared. In addition, the influence of different pipe spacing and diameters of refrigeration pipe on the heat transfer resistance of the track is also analyzed. The results showed that compared with the ice track without sunshade facilities, TWPS could reduce the heat transfer between ice surface and air by 17.6% in the transition season, and TWPS with low emissivity material could reduce the heat transfer by 37%. The thermal resistance of the ice track decreased by $8.9 \times 10^{-4} \text{ m}^2 \cdot \text{C}/\text{W}$, and the refrigerant evaporation temperature increased by $0.25 \text{ }^\circ\text{C}$ when the cooling pipes spacing decreased by every 10 mm. The thermal resistance decreased by $1.46 \times 10^{-3} \text{ m}^2 \cdot \text{C}/\text{W}$, and the refrigerant evaporation temperature increased by $0.3 \text{ }^\circ\text{C}$ when the pipe diameter increased by one nominal diameter.

Keywords : bobsleigh/skeleton ice track, calculation model, heat transfer characteristics, refrigeration

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